N.A.C.A. BULLETIN

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EDITORIAL DEPARTMENT NOTE

One of the attractions of punched card tabulating and listing equipment for accounting purposes is the number of summaries and reports which can be compiled by mechanical means once the source data has been punched into the cards. The opening article in this issue of the *Bulletin* makes the most of this advantage and describes a system in which cards punched with appropriate sales or unit cost data are integrated into a routine providing not only the regular book entries and detail for sales, cost of sales, and accounts receivable but also varied and informative control analyses of sales, gross profit, and finished goods inventories.

The article is written by LESTER P. RIDDLE, Tabulating Supervisor of R. G. LeTourneau, Inc., Peoria, Ill. Mr. Riddle has been responsible for the development of his company's tabulating system which extends to material and production control and personnel records. Five domestic manufacturing locations are involved in the operations controlled and two foreign ones, as well as world-wide distributor contacts.

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Scrap is an elusive element of cost in many lines, defying measurement in the intervals between physical inventories, and is frequently hard to segregate at any time. Our second article reports a study of scrap costs in one company engaged in parts manufacture, which yielded practical benefits. There may well be other companies in which the same approach would minimize the accumulated error in scrap estimate disclosed at inventory time and so increase the reliability of interim operating statements. It may be noted that the company found its most helpful data for this study in records underlying operations on a standard cost basis.

The author, ANDREW J. HIEFTJE, was formerly an instructor in mathematics and then, progressively, cost department supervisor and assistant chief accountant with Sealed Power Corp., Muskegon, Mich. Since 1945 he has been Senior Accountant on the staff of Lawrence Scudder & Co., certified public accountants of the same city.

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Accounting for fixed assets has become a more than important topic in many companies whether because of current or contemplated plant expansion, the existence of useful facilities originally constructed for wartime production, review of depreciation base, or other reason. A recent issue of the *Bulletin* outlined punched card procedures for accounting for fixed assets. This issue closes with an article setting forth manual procedures adopted by the company in question early in the war period, and which have proved to be serviceable during the five years since their installation. An aid to production control is discerned in the existence of fully descriptive records of machinery and equipment.

DONALD R. THOMPSON, author of the presentation, is Secretary, Controller, and a Director of The Snow-Nabstedt Gear Corp. Mr. Thompson entered the employ of the company in 1940 as Cost Accountant following some fifteen years of experience in public and industrial accounting, with a period of service in the field of retail accounting also.

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NOVEMBER 15, 1947

ANALYTICAL AND ACCOUNTING CONTROL OF SALES AND GROSS PROFIT BY PUNCHED CARDS

by LESTER P. RIDDLE,
Supervisor of Tabulating, R. G. LeTourneau, Inc.,
Peoria, Ill.

EXECUTIVE CONTROL, which is the watchword of successful modern business, is effectively attained and maintained through a scientific approach to management problems, based upon an adequate knowledge of what we may call figure facts. The following description of an over-all sales accounting plan will indicate how accounting control, control of sales effort and advertising, and gross profit and inventory control, may be achieved to a large extent through the use of mechanized procedures which make possible timely analysis of sales and related figure facts.

Recognizing the Needs to Be Met

In developing this sales accounting system, we took note of the difference in the requirements of the controller and the sales executive. The controller's requirements demand that records readily provide totals for financial statements and that associated records such as accounts receivable, cost of sales, and inventories be prepared in such a manner that their accuracy is constantly proved and readily audited. Although sales executives are interested in the same set of financial transactions, their purposes call for analysis and summarization according to selected classifications which will permit rapid interpretation and facilitate managerial control. As worked out our setup permits the preparation of all general and managerial sales accounting reports required for executive appraisal and control from a single coordinated routine. For the purpose of this discussion, we have divided the over-all plan into four functional classifications:

1. Sales analysis.
2. Accounts receivable records and agings.
3. Cost of sales and gross profit.
4. Distributors' inventories and sales.

In presenting our system in this article, it has been attempted to confine procedural explanations as much as possible to the accompanying charts and to focus attention on the results accom-

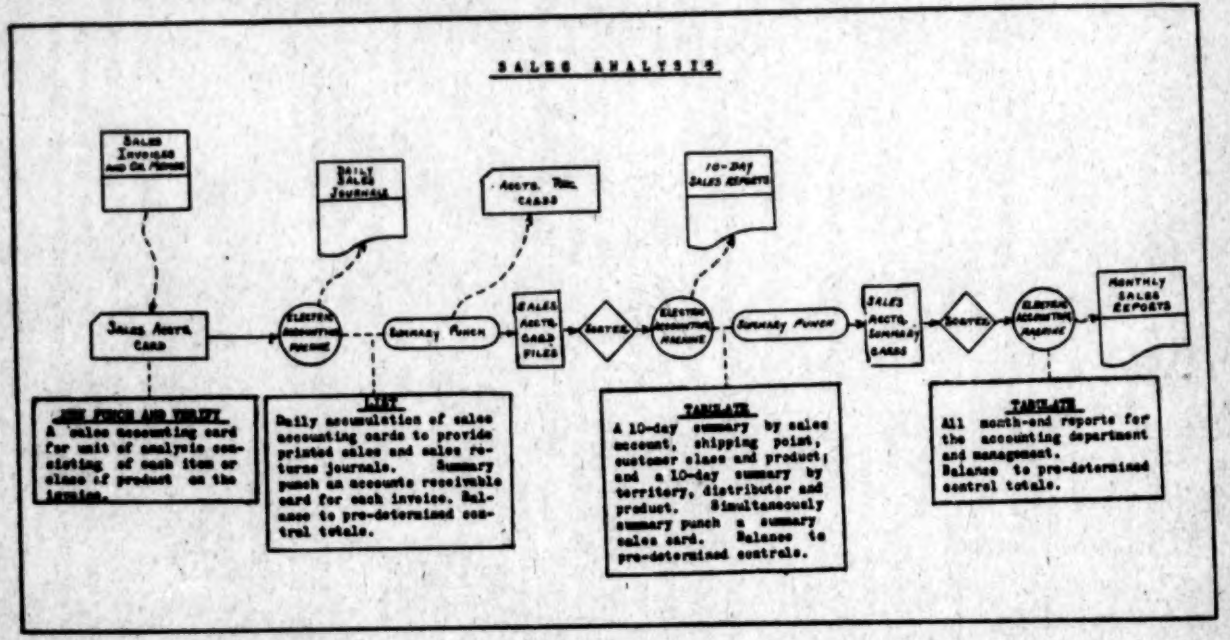
SALES ANALYSIS
Sales Invoices and Cr. Memos
Daily Sales Journals
Accts. Rec. Cards
10-Day Sales Reports
Sales Accts. Card
Summary Punch
Sales Accts. Card Files
Sorter
Summary Punch
Sales Accts. Summary Cards
Sorter
Monthly Sales Reports
KEY PUNCH AND VERIFY
A sales accounting card for unit of analysis consisting of each item or class of product on the invoice.
LIST
Daily accumulation of sales accounting cards to provide printed sales and sales returns journals. Summary punch an accounts receivable card for each invoice. Balance to pre-determined control totals.
TABULATE
A 10-day summary by sales account, shipping point, customer class and product; and a 10-day summary by territory, distributor and product. Simultaneously summary punch a summary sales card. Balance to pre-determined controls.
TABULATE
All month-end reports for the accounting department and management. Balance to pre-determined control totals.

EXHIBIT 1

plished along the line of a wide range of prompt and informative reports and on the smooth functioning of the whole routine.

Sales Analysis

As in all companies, our sales accounting problem is set by our products and the market developed for them. The products, which consist of all types of earth moving equipment, reach around the world. There are fifteen major types of equipment in two hundred and thirty models. Manufacturing plants are seven in number, including two abroad. Sales are to distributors who in turn sell to the ultimate users and service the users' equipment.

In developing our routines for sales accounting, which may be followed through on a step-by-step basis in Exhibit 1, we found it desirable to construct classification codes to obtain maximum benefits. The revenue accounts in our general books were coded for the regular chart of accounts and this coding suffices to identify all of the accounts for which totals are required. We developed codes for distributors, territories, users, industries, geographic locations, and products.

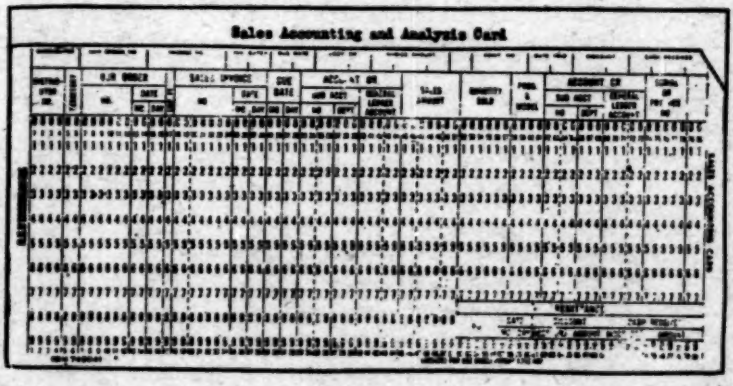

EXHIBIT 2

A sales accounting and analysis card record (Exhibit 2) is punched for the unit of analysis which consists of each item or class of product on the invoice. These cards are machine verified for assurance of accuracy. Each day's accumulation of sales accounting cards is tabulated by an electric accounting machine to provide printed sales and sales returns journals. Daily journal totals are entered in a sales accounting control book and balanced

against predetermined control totals. Simultaneously with the tabulating of sales journals, the summary punch automatically punches an accounts receivable card for each invoice which, as will be seen later, gives us our accounts receivable ledger. This card is identical with the sales accounting card except for color.

Sales reporting begins with two sales summary reports prepared at ten-day intervals by tabulating the accumulation of sales accounting cards for that length of time. The first of these reports provides a summary by sales account, shipping point, customer class, and product. The second summary is by territory, distributor, and product. Simultaneously with the running of each of these reports, sales accounting summary cards are automatically summary punched to contain the ten-day totals according to the classifications included in the report. The report totals are entered in the sales accounting control book and balanced against predetermined control totals. The summary cards facilitate speedy and economical tabulation of similar but rather more extensive analytical reports that are essential at the close of the month. Meanwhile, the interim summary reports serve to keep management informed throughout the month and are of major importance to all executives. Comparison of the results shown by these sales analyses with sales and production budgets enables executives to exercise control intelligently, providing current pertinent data as to progress.

At the close of the month, the sales accounting summary cards are tabulated by electric accounting machine to provide the following reports:

1. Accounting summaries of sales journals.
2. Sales by product and model.
3. Sales by division, product, and model.
4. Sales by shipping point, customer class, and product.
5. Sales by district representative, product, and model.
6. Sales by district representative, distributor, product, and model.

These end-of-the-month reports may be classified as fiscal reports of a historical nature in the sales area. The first provides the controller with the totals required for the general books and financial statements. The others provide part of the analytical and comparative data which enables sales management to plan sales effort intelligently and control the operations involved in

the distribution of products. Incidentally, analytical and comparative data on sales alone are not sufficient to do this. A later section of the article will show how essential analytical and comparative data on profits are also provided simultaneously with sales facts.

There are current self-proving features in our plan which would be difficult to provide by any other method. Entries made in the control books during the month serve to establish predetermined control totals for each report. We are assured before releasing any report that it is accurate and in agreement with figures in the general books.

Accounts Receivable Records and Agings

During the preparation of sales journals, accounts receivable tabulating cards are automatically prepared and, as indicated above, are duplicates of the sales analysis cards except for color of stock. These cards constitute the accounts receivable ledger file and are placed in it by mechanical means in date sequence by customer account number. There they are available for reference, analysis, and ultimate withdrawal from the active file upon payment or credit.

Remittance statements are prepared by the cash receipts clerk and furnish the basis for applying credits to customers' accounts for payments made. Payments are applied by removing from the accounts receivable ledger file the "charge cards" that are paid in full. These cards are completed by punching the amount paid, discount allowed, and date paid. The cards covering these payments are used to prepare the cash receipts journal and the totals obtained when preparing this journal afford proof that the cash credit cards and the cash receipts control total are in agreement.

It will be apparent that we need no other accounts receivable ledger than the file cards of open charges. This permits automatic tabulation of all unpaid items to prepare "aged" statements showing amounts owing for the current month and amounts which have been due for periods of 30, 60, and 90 days or more. The total obtained when preparing the "aged" statements is actually an "aged" trial balance. It would be difficult to prepare one which would be as complete and comprehensive by any other method, and its dual purpose is achieved in a single operation.

Various factors influenced the choice of the routine, outlined in chart form on Exhibit 3, best adapted to our requirements. A

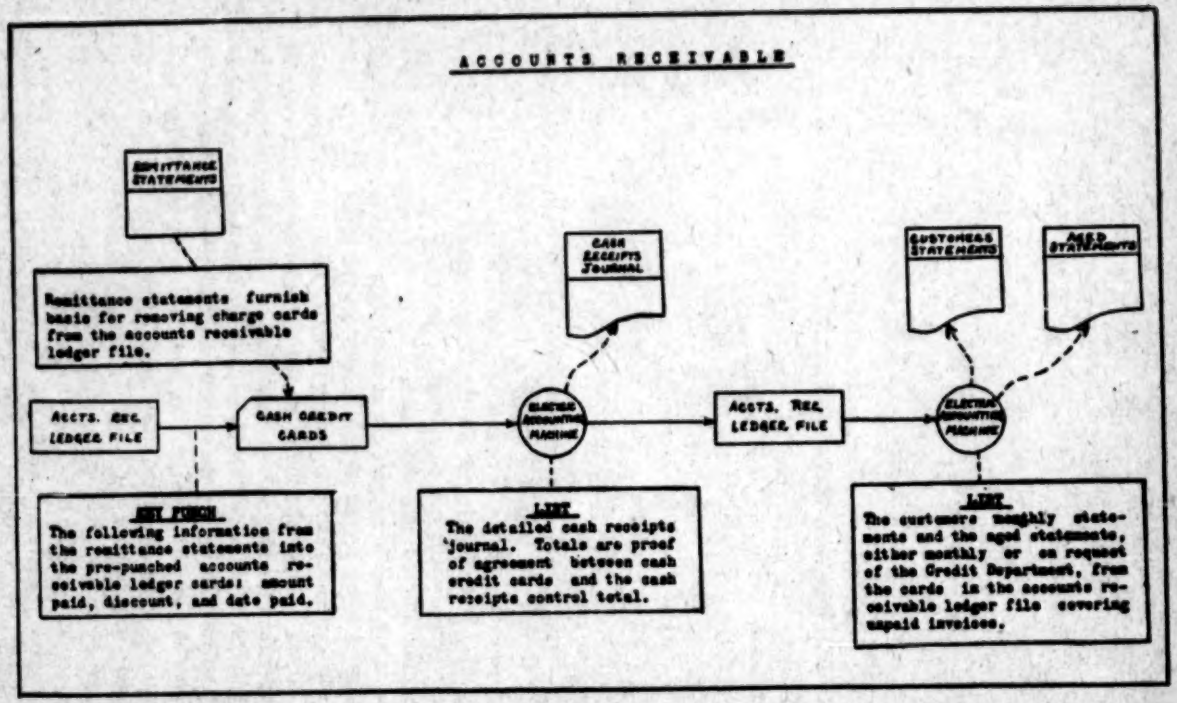
ACCOUNTS RECEIVABLE
REMITTANCE STATEMENTS
Remittance statements furnish basis for removing charge cards from the accounts receivable ledger file.
ACCTS. REC. LEDGER FILE
CASH CREDIT CARDS
KEY PUNCH
The following information from the remittance statements into the pre-punched accounts receivable ledger cards: amount paid, discount, and date paid.
CASH RECEIPTS JOURNAL
LIST
The detailed cash receipts journal. Totals are proof of agreement between cash credit cards and the cash receipts control total.
ACCTS. REC. LEDGER FILE
CUSTOMERS STATEMENTS
AGED STATEMENTS
LIST
The customers monthly statements and the aged statements, either monthly or on request of the Credit Department, from the cards in the accounts receivable ledger file covering unpaid invoices.

EXHIBIT 3

review of these factors will indicate not only why we can use tabulating equipment for our receivable records but also the almost unlimited flexibility which our system provides. The following five points are perhaps the most important:

1. *Open item statements*—The procedure selected permits the use of the open item statements consisting of complete listings of data pertaining to each transaction for which no payment has been made or upon which a partial payment only has been applied. This type is more advantageous than the balance forward type of statement because of the elimination of customer correspondence ordinarily entailed in clarifying the details which have been grouped in the opening balance.

2. *Remittances*—In our company most remittances are received promptly and can be applied directly to the full payment of each invoice or charge, and so are reflected in our ledger by the removal of a single tabulating card. Occasionally we do receive partial payments, but these as a rule apply against designated charges.

3. *Credit authorization*—The selected procedure permits the application of effective credit control through promptly prepared periodic agings and analyses which may be adapted to meet the problems confronting the credit department.

4. *Internal checks*—The procedure permits daily proof of agreement between the cashier's predetermined control totals, the cash receipts journal, and the deposit slips.

5. *Elimination of duplication of handling and recording entries to various records*—From an operating standpoint this is one of the most important factors. The procedure provides for a minimum amount of posting to intermediate records.

6. *Maintaining even flow of work*—The routine permits daily mechanical proof of balance during the month, and the release of customers' statements promptly after the close of the month. This factor of timely processing of work is important likewise in facilitating effective internal checks.

EXHIBIT 3

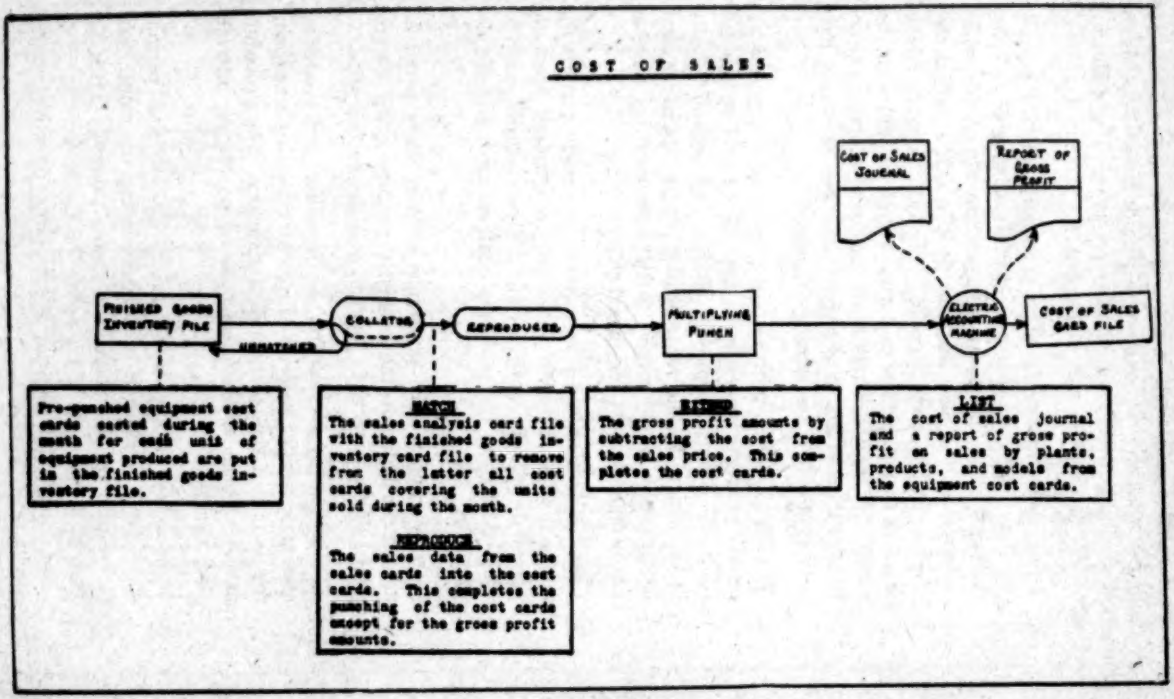
COST OF SALES
COST OF SALES JOURNAL
REPORT OF GROSS PROFIT
FINISHED GOODS INVENTORY FILE
COLLATOR
REPRODUCER
MULTIPLYING PUNCH
ELECTRIC ACCOUNTING MACHINE
COST OF SALES CARD FILE
SORTER
Pre-punched equipment cost cards casted during the month for each unit of equipment produced are put in the finished goods inventory file.
MATCH
The sales analysis card file with the finished goods inventory card file to remove from the latter all cost cards covering the units sold during the month.
REPRODUCE
The sales data from the sales cards into the cost cards. This completes the punching of the cost cards except for the gross profit amounts.
EXTEND
The gross profit amounts by subtracting the cost from the sales price. This completes the cost cards.
LIST
The cost of sales journal and a report of gross profit on sales by plants, products, and models from the equipment cost cards.

EXHIBIT 4

Cost of Sales and Gross Profit

Since the type of unit cost we use is a standard cost, current detailed costing during the month is possible and we take advantage of it. The sequence of operations follows that shown on Exhibit 4 giving the steps under which detailed costing is developed into detailed analyses of gross profit and other data.

The answer to "What was the gross profit?" can only be established by determining the difference between sales value and the cost of goods sold. The accuracy of such a calculation is usually dependent upon the existence of data pertaining to the unit cost of products sold. In our case all costing for detailed reports is performed by referring to an auxiliary file recording the standard unit costs for items of equipment manufactured.

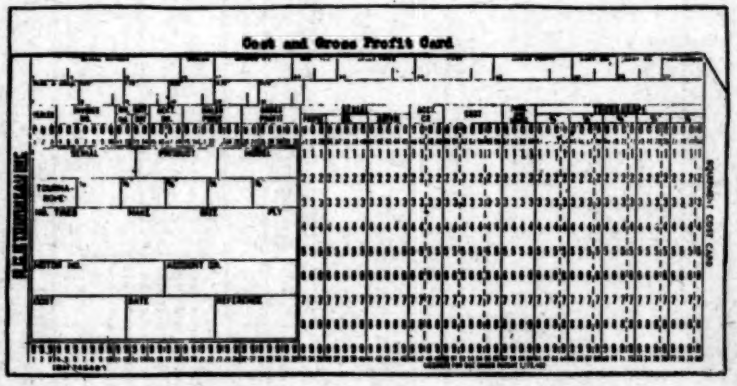

EXHIBIT 5

The practice of applying the cost to each item sold has been rather widely adopted and in our case this procedure affords the most economical method of compiling the necessary cost and profit data because our equipment ranges in sales value from one hundred dollars up to several thousand dollars per unit. Although the same general results could be obtained by a summary costing method, the relative merits of the detailed costing method in facilitating inventory control and in providing cost and profit data according to a variety of classifications favors the detailed costing method for our use.

As units of equipment are costed upon completion during the month, prepunched equipment cost cards (Exhibit 5) are placed

EXHIBIT 4

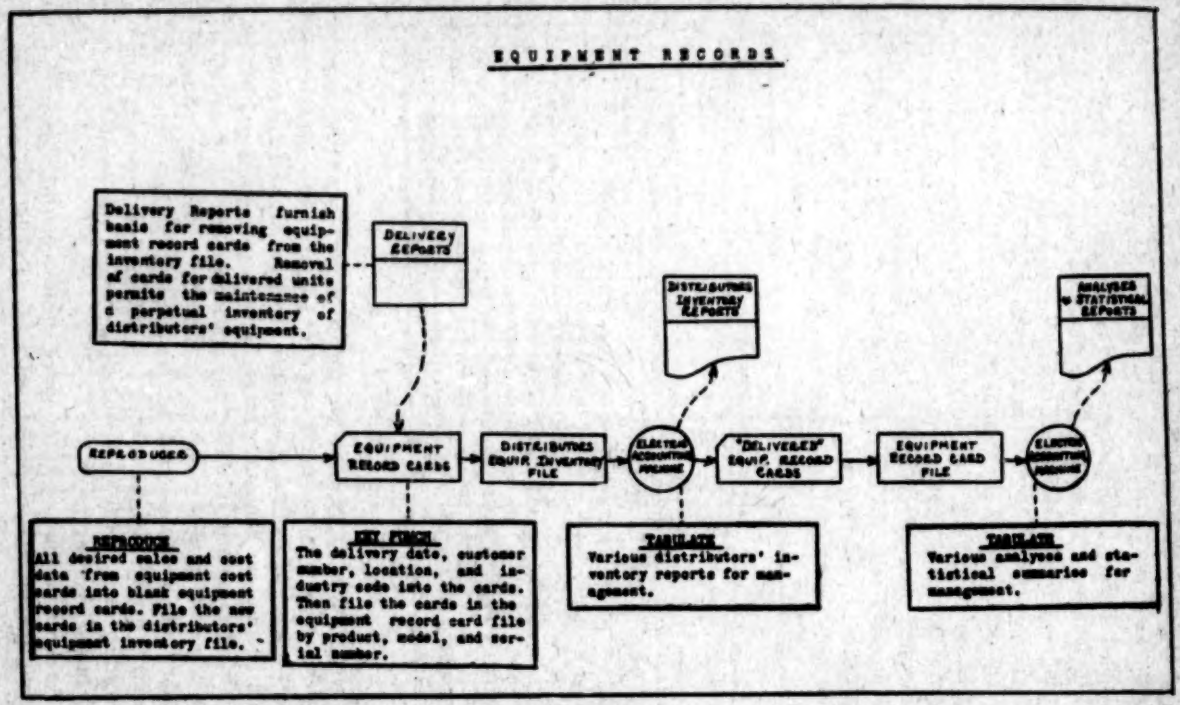
EQUIPMENT RECORDS
Delivery Reports furnish basis for removing equipment record cards from the inventory file. Removal of cards for delivered units permits the maintenance of a perpetual inventory of distributors' equipment.
DELIVERY REPORTS
DISTRIBUTORS INVENTORY REPORTS
ANALYSES & STATISTICAL REPORTS
REPRODUCER
EQUIPMENT RECORD CARDS
DISTRIBUTORS EQUIP. INVENTORY FILE
ELECTRONIC ACCOUNTING MACHINE
"DELIVERED" EQUIP. RECORD CARDS
EQUIPMENT RECORD CARD FILE
ELECTRONIC ACCOUNTING MACHINE
REPRODUCER
All desired sales and cost data from equipment cost cards into blank equipment record cards. File the new cards in the distributors' equipment inventory file.
KEY PUNCH
The delivery date, customer number, location, and industry code into the cards. Then file the cards in the equipment record card file by product, model, and serial number.
TABULATE
Various distributors' inventory reports for management.
TABULATE
Various analyses and statistical summaries for management.

EXHIBIT 6

in the finished goods inventory file. This effects unit control of finished goods inventories by automatically establishing a card record associated directly with each unit of inventory. The physical removal of units of this record from the file reflects the change in finished stock as sales are made and likewise automatically keeps the finished goods inventory current. The removal is accomplished by the simple process of bringing the sales analysis card file into play and running it through a collator with the inventory card file. Sales data is then mechanically reproduced from the individual sales cards into the corresponding cost cards so removed. Gross profit amounts are also mechanically entered by running these cost cards through a multiplying punch. In cases where the cost exceeds sales price, the gross profit amount shown is, of course, a negative amount. Cost cards related to sales for the period are also tabulated by electric accounting machine for the purpose of preparing the cost of sales journal. A report of gross profit on sales by plants, products, and models is likewise prepared.

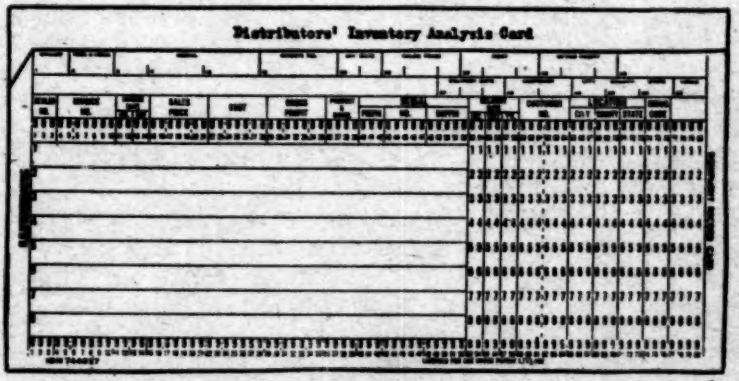

EXHIBIT 7

Distributors' Inventories and Sales

Our records carry a step or two beyond our own sales of the equipment to our distributors. The mechanics of producing the additional information is shown in flow form on Exhibit 6. At the end of each month all significant sales and cost data are reproduced from the cost cards into another set which we call equipment record cards (Exhibit 7) and which have a primary use to reflect distributors' inventories, and a myriad of subsidiary uses.

These equipment record cards are mechanically filed in the distributors' equipment inventory file which we maintain in our office as a statistical extension of our records.

Distributors are required to prepare delivery reports on all deliveries made to customers from their equipment inventories. Upon receipt of these delivery reports, equipment record cards representing units delivered are removed from the distributors' equipment inventory file and the delivery dates, customer numbers, locations, and industry codes are punched into the cards. This is all on a statistical basis, although fully controlled, inasmuch as distributors' sales are postaccounting data so far as our books are concerned. Thus the perpetual distributors' equipment inventory is relieved and the completed equipment record cards are transferred to file where they are arranged by customer and product. The cards remaining in the distributors' equipment inventory file at the end of the month are tabulated by electric accounting machine to prepare reports on status of distributors' equipment inventories. These reports indicate whether or not any distributor's stock of equipment is inadequate and serve as a basis for sales effort.

Uses of Data

Any decline of revenue from channels in which we are vitally interested can usually be checked or reversed by effective follow-up in selected trade journals and revived salesmen's activities. Statistical summaries permit comparison of sales and gross profits by geographic areas with business charts, trade and other selected sales indices, quotas, advertising and selling expense, etc. Vital figures are available for any single factor or combination of factors that affects profits—profit by distributors, profit by district representatives, profit by geographic areas, profit by customers, profit by products and models, and profit by industries. In addition, one of the chief values of such reports is the directness with which comparisons between activities of individuals may be made.

This routine is simple, comprehensive, and effective, and it eliminates many clerical operations ordinarily performed manually. The plan functions in almost complete freedom of error because each operation is controlled and the human element is reduced to a minimum. Multiple use of data makes the plan very economical to operate. The speed, facility, and promptness with which all operations are performed make the system effective.

DETERMINATION OF SCRAP ALLOWANCE—STAGE OF COMPLETION METHOD

by ANDREW J. HIEFTJE,
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Muskegon, Mich.

HISTORICAL RECORDS of scrap loss in a plant where such records seem only to portray a lack of uniform pattern and consistency may, not unnaturally, be set aside as worthless. Indications of alternating high and low wastage with no apparent clue to the reasons for variations from period to period confuse the analyst, however hopeful, to the point of frustration. His job is to establish a basis for a standard scrap allowance so that monthly charges to production costs and corresponding credit to work in process inventory for this purpose will be accurate for all practical ends, permitting reliance on monthly operating statements with respect to this element of cost and avoiding year-end inventory adjustments resulting from estimates of scrap which were either too high or too low.

Difficulties of the Task

The job is not enviable because, for practical reasons, it is not possible to recommend more frequent physical inventories or individual costing of scrapped pieces. As to the former alternative, the process cost system in force does not seem to lend itself to the taking of physical inventories more often than annually. With regard to the latter, the number of pieces involved renders individual costing out of the question as a current procedure despite the existence and use of unit standard costs which make it a theoretical possibility. Unless the analyst is willing to take the unpromising historical records seriously, he would appear to be reduced to the alternatives of setting a scrap allowance on intuition only, recommending that process costs be abandoned despite their fitness for the plant's operations, or throwing up his hands.

Piece Production Basis

It would not be exactly true to say that the scrap problem had been ignored in the past. Our baffled analyst discovers some detailed charts of scrap experience comprising records of plant operations over a considerable period of time. What continues to

Scrap Estimate—Piece Production Basis

	Units produced		Std. cost of good units	Per cent scrap units to good units	Scrap estimate piece production basis	Std. cost of units scrapped	Excess credit to work in process
	Good units	Scrap units					
	(in thousands)						
1936	6,450	813	$ 132,210	12.6%	$ 16,644	$ 11,752	$ 4,892
1937	8,213	1,330	165,905	16.2	26,876	18,714	8,162
1938	8,771	1,658	192,081	18.9	36,303	25,073	11,230
1939	10,609	1,623	248,263	15.3	37,984	24,126	13,858
1940	14,130	1,653	340,533	11.7	39,842	24,362	15,480
1941	16,218	3,276	403,828	20.2	81,573	50,578	30,995
1942	17,984	2,536	453,197	14.1	63,900	38,980	24,920
1943	16,735	1,726	425,070	10.3	43,782	26,861	16,921
1944	14,555	1,980	360,964	13.6	49,091	30,925	18,166
1945	12,191	2,121	305,994	17.4	53,242	33,010	20,232
	125,856	18,716	$3,028,045	14.9%	$449,237	$284,381	$164,856
1946							
Jan.	1,031	145	$ 25,569	14.1%	$ 3,605	$ 2,090	$ 1,515
Feb.	1,270	88	32,258	6.9	2,258	1,350	908
March	1,196	133	30,976	11.1	3,438	2,114	1,324
April	973	91	24,617	9.3	2,289	1,417	872
May	833	61	20,742	7.3	1,514	899	615
June	809	74	20,791	9.2	1,912	1,146	766
July	825	112	20,955	13.6	2,849	1,713	1,136
Aug.	1,002	90	25,551	9.0	2,044	1,453	591
Sept.	976	98	24,693	10.0	2,469	1,489	980
Oct.	1,091	101	27,384	9.3	2,444	1,497	947
Nov.	1,230	75	31,242	6.1	1,905	1,073	832
Dec.	1,174	144	30,172	12.3	3,711	2,230	1,481
	12,410	1,212	$314,950	9.8%	$30,438	$18,471	$11,967

Exhibit 1

confuse is the absence of constancy in the data. As a matter of fact they hold, or perhaps hide, a bright and shining light and the analyst does not see it. In seeking firm ground and a working base which will be promptly available for use each month, he finds himself giving more importance to relationship between good pieces produced and scrap pieces produced than to derived data and this preoccupation is still strong as he culls from reams and reams of process data the figures shown in Exhibit 1. These develop a scrap allowance as it might be arrived at from this relationship, by years from 1936 to 1945 and by months for 1946. It indicates to the analyst what would *not* work.

The most helpful and, at the same time, tantalizing column on Exhibit 1 is the one next to the extreme right which shows the aggregate standard cost of units scrapped. This represents the results of individual costing of scrapped pieces which has been mentioned and if it could practically be compiled every month with respect to the thousands of imperfect items which are cast aside at one stage or another of processing, would itself solve the scrap estimate problem. As matters stand, however, the figures in this column comprise a strictly research job. They do, however, test the reasonableness of the figures in the preceding column.

Exhibit 1

It will be readily observed from the "excess credit" column that a scrap estimate based on the percentage of scrap pieces to good pieces produced in any one month yields an allowance which is not only much too high but irregularly so, running between about 35 per cent and 75 per cent over the test amount. If it was hoped to discover that this method, although assuming in error that scrap pieces carry full cost, would give a scrap allowance which could be immediately reduced to reasonable accuracy by the application of a factor, the analyst suffers disappointment. Of course, he knows that the relationship he has been trying to make use of is not a direct relationship to the cost of the pieces scrapped but he is disappointed none the less.

Turning to Unit Cost Data

What to do? He scans the figures in Exhibit 1 and toys with the idea of tabulating the experience relationship shown between aggregate standard cost of scrapped units and aggregate standard cost of good units in each period. The standard cost of scrapped units will not be available as operating data but perhaps a dependable relationship exists which, unlike the piece production rela-

RATIO OF STANDARD COST OF SCRAPPED PIECES TO STANDARD COST OF GOOD PIECES

	Average unit standard cost		
	Good units	*Scrap units*	*Per cent*
1936	$ .0205	$ .0145	71
1937	.0202	.0141	70
1938	.0219	.0151	69
1939	.0234	.0149	64
1940	.0241	.0147	61
1941	.0249	.0154	62
1942	.0252	.0154	61
1943	.0254	.0156	62
1944	.0248	.0156	63
1945	.0251	.0156	62
Average	$ .0241	$ .0152	63
1946			
Jan.	$ .0248	$ .0144	58
Feb.	.0254	.0154	61
Mar.	.0259	.0158	61
Apr.	.0253	.0156	62
May	.0249	.0148	59
June	.0257	.0151	59
July	.0254	.0153	60
Aug.	.0255	.0161	67
Sept.	.0253	.0153	60
Oct.	.0251	.0147	58
Nov.	.0254	.0143	56
Dec.	.0257	.0154	61
Average	$ .0254	$ .0152	60

EXHIBIT 2

tionship, will afford a serviceable ratio which will give a reasonable scrap estimate if applied period by period to standard cost of good units. Here, however, the light begins to dawn on our analyst for, although he feels he might come closer to a proper scrap allowance in this way, he withholds his hand. He suddenly sees quite clearly that whether use is made of quantity or cost relationship of scrap to good production in the aggregate, variations relating solely to volume of production are made to appear to reflect variation in cost of scrapped pieces. Working with the same data, he turns his attention to unit costs to find the constant relationship, not affected by extraneous circumstances, which will afford the desired scrap entry basis.

The result is Exhibit 2, showing unit standard costs of good and scrapped pieces respectively, obtained by division from data shown on Exhibit 1, and setting forth the percentage relationship

of these two costs over the ten annual and twelve monthly periods covered. The temptation of the analyst is to heave a full dress sigh and exclaim "What a difference!" Where before no line of interpretation was suggested by the data, an indicative constancy immediately shows up in the respective unit costs and is even clearer in the ratio of the two sets of unit costs, indicating substantial correlation. Since 1939, the average standard cost of scrapped units at the stage of completion reached has remained between 60 per cent and 63 per cent of the average standard cost of good units manufactured. The lowering of the ratio from the 69 per cent to 71 per cent relationship of 1936 to 1938 more or less corresponds with the initiation of floor inspections and slight trend downward in 1946 goes along with cost control efforts in this area.

Applying Stage of Completion Method

It remains for the analyst to demonstrate to his own satisfaction that it would make little difference to the accuracy of the scrap estimate if a selected percentage in the indicated range should be adopted as a constant factor to be applied each month to average standard unit cost of good production to obtain approximate average standard cost unit of pieces scrapped. Sixty-two per cent was chosen after a study of Exhibit 2 as not materially higher than indicated current performance and yet on the conservative side. The test consisted of applying, as shown in Exhibit 3, the stage of completion method of costing scrap at this ratio to the periods reflected in the earlier exhibits. A comparison of the "near misses" disclosed in the "excess credit" column with the substantial sums in the corresponding column in Exhibit 1 will justify the elation which our analyst now feels.

Further Check of Stage of Completion Scrap Cost Ratio

He is, however, a Missouri man himself and does not expect others to be credulous. The aggregate and average unit standard cost of scrapped pieces compiled in the course of his investigations and essential to the results, do not have the same tie-in to the general books that can be supplied for the standard cost of good pieces. Thus, on the possibility that summarization might have been faulty, the soundness of the percentage of completion ratio of unit standard cost of scrapped pieces to unit standard cost of good pieces were subjected to testing in another way.

SCRAP ESTIMATE—STAGE OF COMPLETION BASIS

	Computation of scrap allowance				Test of allowance	
	Units scrapped	*Average unit cost, good units*	*Extension*	*62 per cent thereof*	*Standard cost of units scrapped*	*Excess credit to work in process*
1936	813,700	$ .0205	$16,680	$10,341	$11,752	$(1,411)*
1937	1,330,500	.0202	26,876	16,663	18,714	(2,051)*
1938	1,657,700	.0219	36,304	22,508	25,073	(2,565)*
1939	1,623,100	.0234	37,979	23,546	24,126	(580)
1940	1,653,200	.0241	39,842	24,701	24,362	399
1941	3,276,000	.0249	81,572	50,574	50,578	(4)
1942	2,535,700	.0252	63,900	39,618	38,980	638
1943	1,725,700	.0254	43,832	27,175	26,861	314
1944	1,979,500	.0248	49,091	30,436	30,925	(489)
1945	2,121,100	.0251	53,239	33,008	33,010	(2)
1946						
Jan.	145,371	$ .0248	$ 3,605	$ 2,235	$ 2,090	$ 145
Feb.	87,630	.0254	2,226	1,380	1,350	30
March	132,756	.0259	3,438	2,132	2,114	18
April	90,489	.0253	2,289	1,419	1,417	2
May	60,809	.0249	1,514	939	899	40
June	74,428	.0257	1,913	1,186	1,146	40
July	112,200	.0254	2,850	1,767	1,713	54
Aug.	90,180	.0255	2,300	1,426	1,453	(27)
Sept.	97,600	.0253	2,470	1,531	1,489	42
Oct.	101,463	.0251	2,547	1,579	1,497	82
Nov.	75,030	.0254	1,906	1,182	1,073	109
Dec.	144,402	.0257	3,711	2,301	2,230	71
	1,212,358	$ .0254	$30,769	$19,077	$18,471	$ 606

* 62% not fully applicable to these years—see Exhibit 2.

EXHIBIT 3

Hundreds of route sheets of completed jobs were collected, making certain that they covered all of the periods of time from 1936 to the date of the review. By multiplying out the standard cost allowance on each operation by the number of pieces which ran over the operation, it was found that the average cost of scrapped units could easily be arrived at. Computing the percentage relationship of this cost to the standard cost of a completed unit was merely a problem of division as illustrated in the simplified example which is given as Exhibit 4. The ratio shown, 58 per cent, is within range and, while earlier runs figured higher and later ones lower, this test process confirmed 62 per cent as the average relationship of scrapped piece cost to good piece cost.

Comments on Use of the Method

Our narrative is complete and we have congratulated the analyst on his persistence and perspicacity, and he has gone on to greener fields. It is perhaps a worth-while thought to note that the stage of completion method of costing scrap out of inventory works best in a manufacturing line in which the following conditions prevail:

1. A process standard cost system is in operation.
2. Large quantities of units of relatively small unit value are produced.
3. The same general type of units are manufactured from year to year.
4. The ratio of scrap quantities to good quantities produced fails, on being tested, to provide reliable scrap estimates.

ROUTE SHEET ANALYSIS

Operation number	*Units run*	*Std. cost allowance*	*Units x cost*
1	1,000	$.00414	$ 4.140
2	980	.00263	2.577
3	979	.00508	4.973
4	974	.00287	2.795
5	941	.00319	3.002
6	923	.00326	3.009
7	908	.00270	2.452
8	901	.00149	1.342
			$24.290
Completed	900	$.02536	22.824
Scrapped	100	.01466	$ 1.466
Stages of completion		58%	

EXHIBIT 4

If these general circumstances characterize the enterprise, trial of the proposed scrap costing method would certainly seem to be in order. However, there is one real caution. Major product classifications should not be combined in applying the method but each should be treated separately, for large differences will be found between the stage of completion percentages of scrap in various product groups.

POINTS OF VIEW

Take a bill of material and set down on a comparative basis the historical and the anticipated future costs of the material called for . . . You may be amazed at the result. (*M. S. Pheils, South Bend*)

* * *

How many cost accountants have never ventured exploratively beyond . . . cost of goods sold? (*E. K. Scott, Boston*)

* * *

It occurs to me that we have gone too far in this business of allocation of expenses. (*Seymour J. Harris, New Orleans*)

* * *

A good cost accountant first determines what information is needed and then proceeds to build his cost system for the specific purpose of producing the desired results. (*J. H. Fryar, Portland*)

* * *

We feel that we have taken budgetary methods from the guide to the control stage and have made our foremen extremely cost conscious. (*Ralph W. Seiler, Buffalo*)

* * *

It seems to me that the answer to employment stabilization is . . . to be found . . . in advanced annual sales planning and steady monthly production scheduling on the part of private enterprise. (*Robert C. Tyo, Syracuse*)

* * *

Replacement of fixed assets *is* a problem of much concern. However, the accounting should be approached . . . cautiously with the view of complying with consistent and established accounting principles. (*W. E. Guinn, Fort Worth*)

* * *

We have adopted the practice of distributing factory burden on the basis of direct material and direct labor costs, whereas we formerly employed a method of distribution in ratio to direct labor only. (*C. H. Ballard, Dallas*)

INSTALLING MANUAL FIXED ASSET RECORDS

by DONALD R. THOMPSON,
Secretary and Controller,
The Snow-Nabstedt Gear Corp.,
New Haven, Conn.

ENTERPRISES have a habit of growing and taking on additional responsibilities and duties. Old routines no longer fill the bill and new ones come to be needed. Our accounting for fixed assets is a case in point. Until 1942 we had followed methods common to many smaller and medium sized plants. Through our voucher register we charged the general ledger with capital additions, detailing them only on memo schedules. Machines and other pieces of equipment were not numbered. Depreciation was applied on a straight line basis to the total of acquisitions for the year at an established rate for each class of assets.

Retirements and sales of assets were recorded in accordance with regular accounting practice in what we thought was an efficient manner, although we were conscious of some drawbacks. This was particularly true when we had two or more entries of cost which applied against the same asset. Then we had to pick the vendor's charge from one place on the schedule, the freight charge from another, the installation charge from another, etc. In other words, the information was not in one place ready for reference at all times. In the main, however, we did all right and since there were not a great many individual assets for which to account, the methods followed were undoubtedly the easiest and most economical way to handle the problem.

However, we have found a way, resulting from the growth of the company, that we think is more efficient and it is the purpose of this article to point out why we changed and how we did it. Before proceeding, it may help a little to get back to first principles. The late Victor Stempf, writing in the *N.A.C.A. Bulletin* for April 15, 1938, quotes from an article by Frederick G. Colley, published in 1915, advocating the maintenance of a plant ledger system, to the effect that, "In a properly organized factory it is neither relatively costly nor inconvenient to provide a means for a constant and current record of plant assets. Such a record, preferably on cards, should provide the best possible vehicle in determining the proper charge for deprecaition." Mr. Stempf

added his own comment that "these are statements to which we may still say Amen."

Uses of Fixed Asset Detail

I should like to add my own "Amen" to that of Mr. Stempf's. Our convictions on the subject have some connection with conditions of the war period. In 1942 we were under the pressure of war work and were planning to build an additional factory and equip it. This was a large order. Our public accountants suggested the wisdom of installing a property record system which would include a complete plant ledger, pointing out that systematic plant and equipment records have a number of uses to an expanding organization which less detailed methods do not have. These uses are generally known to most accountants but since a number of them have been tersely stated by H. B. Grouse in Section II of the *N.A.C.A. Bulletin* for March 15, 1930, it might be well to repeat them here.

"1. The need for supporting detail with respect to capital investment accounts.
"2. The basis for more accurate depreciation charges and consequent effect on cost of operations.
"3. A more accurate basis for determining insurable values and for substantiating claims for losses sustained.
"4. A sounder basis for tax returns, both income and property."

To these I should like to add:

5. One portion of the basis for a production control system.
6. Dependable basis for entries reflecting the retirement and sale of plant assets.

A consideration of these factors led us to decide to install a plant ledger for our new factory and, in order to make the system company-wide, to include in it the capital assets of existing departments.

Assembling the Facts

The problem of setting up the ledger detail for the new plant was naturally simple. As the new assets were received or constructed, it was only necessary to enter them on the subsidiary plant ledger sheets which were devised, and are described later,

and to effect agreement with the related general ledger accounts. The existing assets, however, were a more complicated matter so that it is with them that we shall deal here. Also, as the procedure was developed in practically the same way for all classes of items, the discussion will be generally confined to machinery, which caused us the most trouble. The extent of our difficulities may perhaps be judged from the following steps into which we classified the work which appeared to us to be necessary if we were to carry out our plan:

1. Prepare a per books inventory of capital assets by accounting classification at cost, and show the portion of the depreciation reserve applicable to each asset at the end of the preceding fiscal year.
2. Take a physical inventory of capital assets by accounting classification and show machine numbers, maker's numbers, and other pertinent data.
3. Reconcile the book and physical inventories.
4. Adjust differences between book and physical inventories by write-off or transfer of assets among classifications.
5. Number all machines.
6. Post and balance the new records and prepare master lists.

Book and Physical Inventories

Since general ledger balances are of no value unless they represent existing conditions, it appeared that our first step was to determine whether or not our present balances were correct by checking our book schedules of fixed assets against a list of the existing assets as shown by a physical inventory. However, to complete a detail per books suitable for this purpose was no small task. We prepared work sheets which listed all of the capital assets charged into the general ledger as far back as we had the information. These sheets took the form shown in Exhibit 1. The year 1927 was the earliest for which particulars were available. Separate sheets were prepared for the several accounting classifications, i. e., buildings, machinery, etc. We put down all of the pertinent data we had on the books or supporting papers, such as type of machine, maker's number, date of purchase, vendor, cost, etc. The balances carried forward from the time when no details were kept, were merely set in as one amount. Fortunately these represented fully depreciated assets later written off against their

MACHINE INVENTORY—PER BOOKS
AND
ALLOCATION OF DEPRECIATION RESERVES

V	Date of purchase	Description	Vendor	Cost	% of yr's pur.	Deprec. reserve	Mach. number assigned or disposition
	1934						
V	May 11	Morris 4' Rad. Drill	Pratt & Whitney	4,500	9.0	2,700	E10
V	May 15	Motor frame for above #21613	Pratt & Whitney	100	.2	60	E10
V	July 1	Used Cincinnati Mill. Mach.	Botwink Bros.	1,000	2.0	600	G3
V	Sept. 15	Heavy Duty Wattmeter	A. W. Post	200	.4	120	Transfer to Tools and Misc.
		Various					
		Various					
		Total for year		50,000	100.0%	30,000	

EXHIBIT 1

MACHINE INVENTORY—PHYSICAL

V	Description	Maker's number	Probable remaining life	Machine number assigned or disposition
V	#3 Cincinnati Mill. Mach.	21613	3 yrs	G3
V	Morris Rad. Drill 4' arm	66789	5 yrs	E10
V	#2A Warner & Swasey Turret Lathe	A1678	1 yr	Purchased prior to 1927. Value unknown. #H4

EXHIBIT 2

reserves. The lists when prepared were tied in with the general ledger balances.

On the same work sheet we allocated the depreciation reserve shown by the books at the end of the preceding fiscal year to each of the items on the list, since we were planning to depreciate the assets individually in our new plant ledger. As mentioned, depreciation had been provided on an over-all basis each year. Although it was easy to apply the class rate to individual items for the full years for which they had been held, we had to resort to allocation to distribute the remaining reserve presumably representing provisions made for depreciation of assets in the years in which purchased. We obtained the precentage of each item to capital additions purchased during the year and made the allocation for the respective years on this basis. The work sheet for each classification, then, gave us in detail our book inventory of individual fixed assets and their respective reserves.

Simultaneously with the preparation of the book inventory, our factory superintendent and his staff, assisted by the accounting department, prepared a physical inventory of all assets in accordance with the classifications furnished by the accounting department. The physical inventory was thoroughgoing and was conducted independently of the listings from the books. It included complete description of each item in the plant, the manufacturers' number and, most important, its probable remaining useful life. This list, exemplified in Exhibit 2, was then submitted to the accounting department for a comparison with the book inventory.

Reconciliation of Inventories

It was now that it really became apparent that our work was not in vain and that a more effective control of assets had indeed come to be necessary. Working from the physical inventory, we checked all of the items against the book inventory. Some were easily located on the book inventory; others were not. The latter were investigated and identified as assets purchased before detailed schedules were kept or items which had been classified in some other account.

Likewise, many items remained open on the book inventory when the physical inventory items had been accounted for and, after rechecking, it was found that many of them were no longer in existence in spite of our conscientious efforts in the past to make proper retirements on the books. It was also found that

some entries to fixed assets might more properly have been classified elsewhere. These amounts had increased the depreciation base, but in more important instances we found from our estimates of remaining life that our depreciation rates had not been adequate. This situation made us realize, of course, that a more effective method of control in prior years might well have saved us a great deal of tax money in addition to giving a truer picture of the company's property.

The inventories of fixed asset items and the reconcilation comprised the major part of the job. It remained only to number our machines, adjust our book balances to the conditions revealed, and to set up the new records which would keep us informed and up to date in the future.

Assigning Machine Numbers

Numbering of machines serves a twofold purpose. It not only provides an easy check and tie-in between the plant ledger and the assets but also gives basic data which can be used for production routing and machine loading. For this reason we considered the numbering process an important part of our fixed asset record installation. Just as in the case of drawing up a chart of accounts, a plan of machine numbering depends on the plant size, departments, etc. In our case we found it a simple matter. We assigned prefix letters to each department such as A for Bullard Department and B for Potter & Johnston, etc. We then assigned a sufficient block of numbers to each department. Numbers 1 through 25, prefixed by A, denoted Bullard department equipment, number 26 to 50, prefixed by B, indicated the Potter & Johnston department items, etc.

At first a metal plate stamped with the machine number was placed on each machine. We found, however, that it was often difficult to attach these so that they could be easily read and we changed our method to merely painting the number on the machine with white paint. A ready identification was thus afforded.

Adjusting the Books

With the numbering of the machines we felt we had really established our inventory on a current basis and were ready to make the book adjustments indicated by the comparison of book and physical listings of machines. The balances carried forward from the years before 1927, on which we had no details, were

regarded as fully depreciated and were written off against the reserves. Items of inventory applicable to this balance were set up in the new ledgers at no value. Some may regard this policy as questionable, as far as the equipment was still in service, but we felt it to be the simplest way. Assets on hand but not properly classified as fixed assets were transferred with their reserves to the correct account. In particular, we found that the dividing line between machines and tools had not been consistently drawn. Assets which were no longer in existence were written off against the scrap or surplus accounts.

Plant Ledger Form

The plant record decided on was simple. It provided for asset description, number, location, maker's number, voucher number, etc., along with space for depreciation charges and accumulated reserve. Exhibit 3 shows the form adopted. It was punched for standard post binders and printed on heavy eye-rest stock which is as serviceable for a card system as for use on post binders, should we find that we wish to change to the filing card method. All of the existing assets and their pertinent data were posted to individual sheets so that when the job was done we had a complete and separate history of each asset, including its cost and depreciation reserve. The sheets were than sorted numerically by departments and tied into the general ledger balance.

After the ledgers were posted and balanced, we drew off a master list of all machines showing items, numbers, and location in the plant ledger, to provide a ready index. We use the index as a finder when necessary and also in making a physical check of our assets at the end of each year. We do this as a regular procedure and when we compare it with the difficulties encountered in inventorying stock, we wonder why so few companies trouble to keep track of fixed assets in this way.

Benefits of the System

We have now been using our plant ledgers for five years and would not be without them. Since the completion of the initial work, which was admittedly difficult, it has been very easy to keep the ledgers up to date as there are relatively few entries to make each month. We know at all times where we stand with respect to our property accounting. Depreciation provisions, the sale and retirement of fixed assets, and recording of resulting gains or

Form 208

EQUIPMENT RECORD

No. A1

Location: Bullard Dept.

Classification: Machinery

Description: 36" Vertical Turret Lathe

Maker's Number: 19610

Purchased From: The Bullard Co.

Date: 6/29/42 Voucher No.: 3033

Remarks: Universal type with 3 jaw combination chucks, 20 HP motor and standard tool equipment. (Reverse of form used for detail)

Date	*Description*	*Charges*	*Credits*	*Balance*
6/29/42	As above	12,896.25		
	Freight (Consolidated Trucking Co. 5/30/42)	55.00		
	Installation	121.86		13,073.11

Life Expectancy: 15 Years

Annual Depreciation: 871.54

DEPRECIATION

Date	*Period*	*Amount*	*Reserve*	√	√	*Date*	*Period*	*Amount*	*Reserve*
12/31/42	½ Year	435.77	435.77						
12/31/43	1 Year	871.54	1307.31						
12/31/44	1 Year	871.54	2178.85						
12/31/45	1 Year	871.54	3050.39						
12/31/46	1 Year	871.54	3921.93						

EXHIBIT 3

losses are now much more accurately handled than before. When the annual check of the master lists is made against the assets themselves, depreciation rates are adjusted if necessary, which makes us feel secure in the knowledge that our depreciation rates for tax purposes are adequate. The matter of securing proper insurance coverage has been simplified, too, and unless the ledgers themselves (which are kept in a fireproof safe) are destroyed, we shall have no trouble in proving any insurance claims we may ever have.

During the war, acquisitions under certificates of necessity were set up in our plant accounts under the certificate numbers and amortized as permitted for tax purposes. The ease with which we wrote off the remaining balances, following the end of the war, on more than $1,000,000 in buildings and machinery in this category, filed our tax refund claims involving the returns of four years, and obtained quick payments with no adjustment at the time of the revenue agent's audit, was particularly gratifying. When, in 1943, we overhauled our production control and machine loading systems, our plant ledger system enabled us to provide immediately a complete list of available machines, their type, numbers, etc., the basic data on which such systems are constructed. Likewise, lining up the ledgers by departments has afforded a ready basis for the distribution of depreciation and repairs overhead.

These are some of the advantages. Others could be mentioned. Plant records are a logical product of a company's growth. If they are installed in the early stages of the growth period they can be set up fairly easily. Later they may pose almost insurmountable difficulties.

COMING ARTICLES

In the *N. A. C. A. Bulletin*, December 1, 1947

Production Control for Maintenance of Balanced Stocks
by C. E. Carlson

A Standard Hour Wage Incentive Plan
by John J. Barranger

Lifo Basis of Valuation as Applied to Cotton Mill Inventories
by E. G. Field